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ABSTRACT

This module on drugs used in blood disorders is intended for use in inservice or continuing education programs for persons who administer medications in long-term care facilities. Instructor information, including teaching suggestions, and a listing of recommended audiovisual materials and their sources appear first. The module goal and objectives are then provided. A brief discussion follows of blood disorders, drugs used for treatment, and considerations and suggestions for resident care. This discussion is intended for use as a lecture or participant reading. Other contents include a worksheet, a vocabulary list, and medication charts, all of which are suitable for reproduction for use as handouts. (YLB)

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DRUGS USED in BLOOD DISORDERS

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Drugs Used in Blood Disorders

Instructor Information

This material is intended for inservice or continuing education programs for persons who administer medications in long term health facilities. It includes a brief discussion of blood disorders, medication charts, and a worksheet which can be duplicated and used by the participant. Suggestions for care of the resident with a blood disorder are included.

Audio/Visual Materials

The following materials are available *free* on loan from Vocational Education Services, 840 State Road 46 Bypass, Bloomington, Indiana 47405, (812) 335-6711.

Concepts in Nutrition: Diet and Health (AVO70036) (filmstrip/tape)
Hematology Techniques I (AV070022)—discusses drawing and preparing blood and the complete blood count.
Hematology Techniques II (AV070023)—explains red cell examination and coagulation.

Drugs for Blood Disorders

Goal

Care of the resident with a blood disorder requires a basic knowledge of symptoms, complications and disease processes as well as an understanding of the medications used to alleviate these symptoms. The goal of this module is to present a basic explanation of several common blood disorders, give suggestions for care of the resident with a blood disorder and list several commonly used medications in their treatment.

Objectives

After completion of this module, the health care worker will:

- Describe two common disorders of the red blood corpuscles
- Describe two common disorders of the white blood corpuscles
- Describe two common disorders of the platelets
- Name one drug used for the treatment of each of these disorders
- Discuss the adverse and side effects of these medications
- Increase word power by learning the vocabulary definitions
- Complete the worksheet with the instructor

General Discussion

The circulatory system is the transport system of the body. It includes the heart, blood vessels, the blood and the lymphatic system. The purpose of the cardiovascular system is to put blood in close contact with every tissue in the body. The blood has three main functions: transportation of food and oxygen to body cells, defense against infection, and assistance with the fluid balance of the body.

Blood has two components. The fluid part is called plasma. The formed elements are called corpuscles. The plasma is made of about 90% water and 10% proteins, carbohydrates, fats, and minerals. Corpuscles consist of Red Blood Cells (RBC) or erythrocytes, white blood cells (WBC) or leukocytes, and platelets (thrombocytes).

Disorders of the Blood and Related Medications

Red Blood Cells

Formation

In people beyond age 20, RBCs are formed in the bone marrow, upper ends of the humerus and femur, the skull, ribs, sternum, clavicle, and vertebrae. The RBC goes through several developmental stages in the bone marrow. The RBC loses its nucleus and acquires a protein molecule called hemoglobin. Erythrocytes are released from the bone marrow into the blood stream.

Erythrocytes are bioconcave discs which must be flexible enough to squeeze through capillary beds single file to transport oxygen and food to the body tissues. The RBC has only about 1 or 2 seconds to take up or release the oxygen molecule and its shape is suited for its function. The RBC red color is due to the presence of hemoglobin, a protein which readily absorbs and releases oxygen into the RBC. RBC formation is dependent on adequate supplies of iron and protein for the production of hemoglobin. RBCs live for approximately 125 days and are destroyed by the spleen, liver and bone marrow.

During disease or aging, the RBC becomes more fragile and may be destroyed at a greater rate.

Disorders of Red Blood Corpuscles (erythrocytes)

Anemia

Definition—abnormally low number of RBC or deficient in the amount of hemoglobin present in the RBC.

Iron deficiency anemia—
iron is a component of hemoglobin. A decrease in iron decreases the amount of hemoglobin resulting in the loss of the ability of the red blood cell to transport oxygen to the tissues.

Causes of iron deficiency anemia

- Excessive bleeding
- Impaired absorption of iron in a person who has disease of small intestine or who has had stomach removed
- Inadequate diet
- Body's increased need for iron during pregnancy, periods of rapid growth or menstruation

Treatment of iron deficiency anemia

- Correct underlying cause of blood loss
- Prescribed iron preparations
- Supply body with food sources of iron (green leafy vegetables, enriched bread and cereal, whole grain, beans, potatoes, dried fruits)

Pernicious Anemia

Cause of pernicious anemia

- Gastric juice does not contain chemical to permit absorption of vitamin B_{12}
- Vitamin B_{12} is responsible for maturation of the red blood cell

Treatment of Pernicious Anemia

- Injections of vitamin B_{12}
- Diet—meat, milk, eggs, cheese—sources of vitamin B_{12}

Polycythemia Vera

Increased number of red blood cells causing weakness, headache, visual disturbances, a reddish purple hue to hands and feet which worsens in cold weather, numbness and tingling of extremities, enlarged spleen and an elevated systolic blood pressure. This disease accompanies cardiac and pulmonary disease. Peptic ulcers are common in these patients. Cerebral, gastrointestinal or nasal hemorrhages may occur.

Cause—unknown

Treatment

- Chemotherapy to reduce number of red blood cells
- Radition to the bone marrow
- Phlebotomy

Complications

- Thrombophlebitis
- Myocardial infarction
- Hemorrhage
- Peptic ulcer
- Gout
- Congestive heart failure

White Blood Cells

Formation—(leukocytes)—bone marrow and lymph tissue

Types of WBCs

Neutrophils
Eosinophils
Basophils
Monocytes
Lymphocytes

Function of WBCs

Fight infestion
Take up toxins (poisons)
Release enzymes
Produce antibodies

Disorders of White Blood Cells (leukocytes)

Agranulocytosis—extreme *decrease* in number of WBC (leukopenia). Can cause death if infection becomes overwhelming.

Causes of leukopenia (agranulocytosis)

- Hypersensitivity to certain drugs
- Viral diseases
- Severe bacterial infections
- Disease of the bone marrow

Symptoms of agranulocytosis

- Chills, fever, sore throat
- Swollen glands, weakness

Other causes of *decreased* leukocytes (Neutrophils)

- Viral infections, septicemia
- Bone marrow damage (poisons)
- Enlarged spleen
- Vitamin B_{12} and Folic Acid deficiency

Treatment—aimed to relieve symptoms

Leukemia—disorder of the blood-forming tissues, spleen, lymph system and bone marrow, producing an *increase* in the number of white blood corpuscles. Leukemia can be chronic or acute. The leukemias are generally characterized by an increase in the number of white blood corpuscles, associated with the enlargement of the spleen, liver, or lymph glands.

Chronic lymphocytic leukemia
Symptoms

- Onset age 45-60 years
- Develops slowly
- Gradual lymph node enlargement
- Anemia, fever, hemorrhage

Treatment

- Obtain remission of symptoms
- Use x-ray, steroids, chemotherapy

Other causes of *increased* leukocytes

Cell Type	Cause
Neutrophil	Infections Cancers, leukemias Poisoning from drugs and chemicals Acute hemorrhage
Lymphocyte	Infections—mononucleosis, TB, whooping cough Some leukemias Overactive thyroid
Monocyte	Infections Certain leukemias Recovery from infections Polycythemia
Eosinophils	Allergic reactions-asthma Worms Skin disease Hodgkins disease

Platelets

Formation—bone marrow

Function—Participate in blood clotting to prevent hemorrhage (coagulation)

Disorders of Platetets (thrombocytes)

Hemophilia—A hereditary disease characterized by prolonged clotting time which results in persistent and severe bleeding.

Cause—genetically inherited disease transmitted from mother to son, occurring with varying degrees of severity

Symptoms

- Bruises easily
- Prolonged bleeding from cuts or wounds
- Hematomas from minor bumps
- Blood in urine
- Bleeding into joints—elbows, knees

Treatment

- Provide immediate emergency care
- Administer blood or component containing necessary clotting factor

Vitamin K Deficiency

Causes

- Obstructive jaundice, biliary fistula (interference of the flow of bile into the intestine)
- Impaired intestinal absorption of vitamin K
- Extensive surgical resection of small bowel
- Poor dietary intake
- Therapy with broad spectrum antibiotics

Symptoms

- Bruising
- Nosebleeds
- Bleeding around the guns
- Blood in urine
- Blood in emesis
- Excessive menses
- Operative and post-operative bleeding

Treatment—vitamin K preparations

Thrombocytopenia—decreased number of platelets in the blood

Causes

- Deficiency of bone marrow
- Increased destruction of platelets by spleen

Symptoms

- *Purpura*—small hemorrhages in the skin, mucus membrane or subcutaneous tissues
- *Ecchymosis*—large areas of hemorrhage under the skin
- Bleeding from nose, mouth, and gastrointestinal tract

Treatment

- Spleenectomy
- Transfusion of platelets

Drugs Used in the Treatment of Blood Disorders

Classification

Vitamins

Definition: organic substances found in many foods that are necessary for the normal metabolic functioning of the body

Forms of Vitamins

Water soluble: vitamin C and B complex; not stored in the body; deficiencies develop quickly
Fat soluble: vitamin A, D, K, and E; stored in muscle, fat, and liver; deficiencies develop slowly

Adverse effects

- Excessive doses of vitamin C may cause diarrhea
- Niacin may cause flushing of skin; large doses may activate peptic ulcers, GI disturbances, rash, hypotension
- Thiamine may cause hives, itching, weakness, and nausea
- Vitamin K may cause flushing sensations and a "peculiar taste" in mouth
- Vitamin B_{12} has no adverse effects
- Folic acid is a B complex vitamin and has no adverse effects

Hematinics (iron)

Definition: a mineral essential to hemoglobin used in the transport of oxygen to the tissues

Types of iron preparations

Ferrous Sulfate—Mol-Iron, Ferrous Sulfate
Iron with vitamin C—(vitamin C aids absorption of iron)—Mol-Iron with C, Ferate-C

Adverse effects of iron preparations

- Oral iron preparations cause nausea/vomiting, diarrhea, or constipation
- Iron preparations are not recommended for residents with ulcerative colitis or peptic ulcer
- Iron preparations can be lethal; symptoms of iron poisoning are:

  Vomiting, tarry stools
  Vomiting of blood
  Weak, rapid pulse, hypotension
  Coma
  Apparent recovery in 24 hours followed by cyanosis, shock, pulmonary edema, coma and death

Chemotherapeutic Drugs

Definition: antineoplastic drugs used to reduce number of RBC by depressing bone marrow or producing a state of remission

Types of antineoplastic drugs

Busulfon (Myleran)
Chlorambucil (Leukeron)
Methotrexate (Mexate)
Mercaptopurine (Purinethol)
Cytarabine (Cytar)
Vincristine sulfate (Oncovin)
Hydrourea (Hydrea)
Procarbazine HCL (Matulane)

Adverse effects

- Nausea/vomiting, sore mouth and tongue
- Anemia, bruising, bone morrow depression
- Skin rash, pruritis
- Hair loss (alopecfectia)
- Urinary stones, infection

Care of the Resident with a Blood Disorder

Considerations	Suggestions
The resident with a blood disorder may have ulcerations of the mouth and gums.	Avoid highly spiced foods; give frequent mouth care with mild mouthwash solutions.
The resident may have a tendency toward bleeding.	Protect patient from injury; observe for symptoms of internal as well as external bleeding; observe for blood in urine or feces; examine skin closely for purpura or ecchymosis.
The resident may complain of dyspnea, bone and joint pain.	Elevate head of bed for dyspnea; pressure of linens can be relieved by using a cradle.
The resident may be tired and weak.	Encourage good nutrition; allow the patient to have frequent rest periods, but encourage ambulation as tolerated.
If resident is receiving iron preparations, stools may be dark green to black.	Inform resident that stool color change is a normal side effect of iron preparations.
Some iron products will stain teeth and gums.	Give liquid iron preparations with plenty of water; advise patient to use good oral hygiene.
The residents resistance to infection is decreased.	Guard patient against exposure to disease; observe for signs of infection.
The resident may exhibit neurological symptoms	Observe resident for numbness and tingling of extremities and ataxia.

Worksheet

Complete the following sentences by inserting the correct word to make it a true statement.

1. The fluid part of the blood is called _____.
2. Another name for a red blood corpuscle is _____.
3. The red blood cell contains a protein molecule which readily attracts oxygen. This protein molecule is called _____.
4. Vitamin B_{12} is used in the treatment of _____.
5. Removal of all or part of the stomach results in the body's inability to absorb _____.
6. Iron preparations have several side effects. Two side effects of iron include _____ and _____.
7. An overdose of iron can cause _____.
8. A vitamin K deficiency results in a defect of the component of the blood called _____
9. Chemotherapy is often used in the treatment of a blood disorder involving the white blood corpuscles. This disease is called _____
_____.
10. The chemotherapeutic agent Leukeron is used to treat polycythemia because it produces a/an _____ in the production of red blood cells.

Vocabulary

Microcytic—an undersized red blood cell

Macrocytic—an oversized red blood cell

Hyperchromic—highly colored red blood cells

Hypochromic—slightly colored red blood cells

Normocytic—normal red blood cell having normal hemoglobin

Normochromic—normal colored red blood cell

Agranulocytosis—a depression of the neutrophil leukocytes

Leukopenia—a decrease of the number of white cells in the blood

Hemolytic—a reduction of red blood cells and hemoglobin

Aplastic anemia—blood corpuscles and platelets not adequately produced due to depressed bone marrow production

Leukocytosis—an abnormal increase in the number of WBC

Thrombocytopenia—decreased number of platelets circulating in the blood

Purpura—small hemorrhages in the skin, mucus membrane, or subcutaneous tissue

Cause and Treatment of Anemias

Type	Causes	Treatment	Side Effect	Interacts With	To Produce
Macrocytic hyperchromic anemias (megoblastic) Pernicious anemia	Lack of vitamin B_{12} and Folic Acid caused by inadequate dictory intake Surgical removal of stomach Inherited absence of intrinsic factor in gastric juice Caliac disease Liver disease	Folic Acid Folvite Vitamin B_c	Skin rash (may mask neurological effects if given for vitamin B_{12} deficiency)	Chloramphenicol Chloromycetin Phenytoin Dilantin Primadone Mysoline Barbiturates	Decreased Dilantin levels in epileptics Interference with intestinal absorption of folic acid
		Cyanocobalamin Vitamin B_{12} Betalin 12	Peripheral thrombosis Diarrhea Itching Anaphylactoid reactions	Neomycin Colchicine Paraaminosalicylic acid Chloramphenicol	Malabsorption of vitamin B_{12}
Microcytic hypochromic anemias Iron deficiency anemia	Insufficient dietary intake of iron and copper Chronic gastrointestinal disease Inadequate metabolism Menorrhagia Pregnancy	Ferrous sulfate Feosol Mol-Iron Telefon Fero-Grad (take after meals; tea, bran may decrease absorption; vitamin C increases effect). *continued below*	Nausea/vomiting Constipation Black stools (elixir may stain teeth; give with plenty of fluids; not usually given for patients with other anemias, peptic ulcer or ulcerative editis; record color and amount of stool; do not dilute in milk or antacids)	Antacids Cholestyramine Pancreatic extracts Vitamin E Chloramphenicol Vitamin C	Decreased iron absorption Delayed response Increased iron absorption

Cause and Treatment of Anemias

Type	Causes	Treatment	Side Effect	Interacts With	To Produce
Normocytic normochromic anemias (number of circulating RBC reduced)	Acute blood loss Chemicals Anticancer drugs Irradiation	Blood transfusion I.V.	Chills Fever Dyspnea Cyanosis Sudden pain in lumber region Flushing of skin Twitching ***Call charge nurse immediately***		

Cause and Treatment of Anemias

Type	Causes	Treatment	Side Effect	Interacts With	To Produce
Hemolytic anemias (rate of RBC destruction increased)	Defective RBC Metabolism, Bacterial, viral and parasitic infections Toxins, enlargement of spleen Liver disease Hereditary defects in red cell formation and shape Sickle cell anemia	Blood transfusion			
Polycythemia (increase in number of RBC)	Dehydration Hyperactivity of bone marrow	Chlorambucil Leukeron	Produces bone marrow depression Nausea/vomiting Skin rash Itching Hair loss (watch for signs of bleeding; give before breakfast or at bedtime to reduce nausea; screen urine for stones; watch for infection; encourage fluids)	None	None
Secondary polycythemia	Emphysema CO_2 poisoning				

continued below

Cause and Treatment of Anemias

Type	Causes	Treatment	Side Effect	Interacts With	To Produce
Polycythemia Vera (chronic progressive disease)	Unknown possible: tumors (bone marrow, kidney, brain) not associated with lack of O_2 in blood				
		Busulfan Myleran	Anemia Bruising Nausea/vomiting Testicular atrophy Sore mouth and tongue Hair loss (watch for signs of infection, urine for stones, persistent cough with dyspnea)	None	None

Drugs Used to Treat Leukemia (Antineoplastics)

Drug	Side Effects	Interacts With	To Produce	Type of Leukemia
Antimetabolites Mercaptopurine Purinethol	Nausea/vomiting, Metal taste Fever Bleeding, Bruising Sore throat Loss of hair	Allopurinol Zyloprim	Slowed inactivation of mercaptopurine	Acute leukemia
Cytarabine Cytosar	Leukopenia Anemia Nephrotoxicity	None		Acute leukemia
Methotrexate Mexate	Anemia Bleeding Diarrhea Dermatitis Hair Loss Intestinal perforation (use sun blocking agent)	Alcohol	Increased liver damage	Acute lymphblastic and lymphatic leukemia
		Probenecid Benemid Phenylbutazone Pyridium Azodine Salicylates Aspirin, etc. Sulfonamides Bactrim Septra Gantanol Gantrisin Azulfidine *continued below*	Increased methotrexate toxicity	

Drugs Used to Treat Leukemia
(Antineoplastics)

Drug	Side Effects	Interacts With	To Produce	Type of Leukemia
Vincristine sulfate Oncovin	Depression of bone marrow production Neurological symptoms Nausea/vomiting Diarrhea Abdominal pain	Given intravenously		Acute leukemia

Antineoplastics

Drug	Side Effects	Interacts With	To Produce	Type of Leukemia
Hydroxyurea Hydrea	Depression of bone marrow production Nausea/vomiting Diarrhea Ulcers on the mucus membrane of the mouth and gastrointestinal system Neurological symptoms Loss of hair Skin problems	(Administered orally) None		Chronic granulocytic leukemia
Procarbazine HCL Matulane	Leukopenia Nausea/vomiting Joint pain	Sedatives Tranquilizers Narcotics and antihistamines Hypotensive agents Phenothiazines Alcohol	Increased central nervous system depression, Antabuse-like reaction	Hodgkins Disease

Drugs Used in Treatment of Clotting Defects

Drug	Side Effects	Interacts with	To Produce	Remember
Menadion/menadiol (vitamin K_3) Kappadione Synkavite Hykinone	Increased prothrombin time Nausea/vomiting Depressed hepatic function Rash Pruritis	Mineral oil Cholestyramine resin Questran	Inhibited GI absorption of Vitamin K	Bleeding usually stops in 3-4 hours Clotting time should be determined.
Phytonadione Aqua Mephyton Mephyton	Dizziness Nausea/vomiting Dyspnea Sweating, Flushing	same	same	